Novel Dynamic Screw-Suture Stabilization System For Syndesmotic Repair Provides Better Anteroposterior Translation And Axial Tibiofibular Joint Stability – A Human Cadaveric Study

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Introduction/Purpose

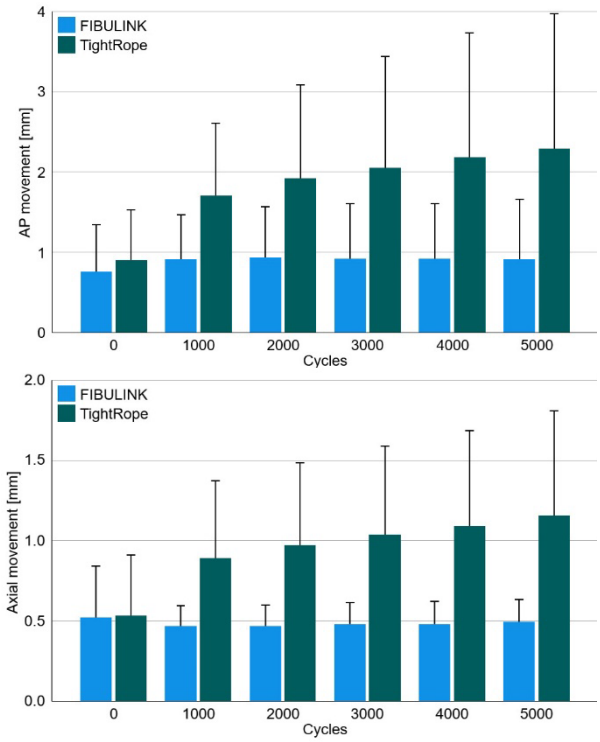
The quest for optimal treatment of acute distal tibiofibular syndesmotic disruptions is still in full progress. Using suture-button repair devices is one of the dynamic stabilization options, however, they may not be always appropriate for stabilization of length-unstable syndesmotic injuries. Recently, a novel screw-suture repair system was developed to address such issues. The aim of this study was to investigate its performance in comparison to a suture-button stabilization of unstable syndesmotic injuries.

Methods

Eight pairs of human cadaveric lower legs were CT scanned under 700 N single-leg axial loading in five foot positions – neutral, 15°external/internal rotation and 20° dorsi-/plantarflexion – in 3 different states: (1) pre-injured (intact); (2) injured, characterized by complete syndesmosis and deltoid ligaments cuts simulating pronation-eversion injury types III and IV as well as supination-eversion injury type IV according to Lauge-Hansen; (3) reconstructed, using a screw-suture (FIBULINK, Group 1) or a suture-button (TightRope, Group 2) implants for syndesmotic stabilization, placed 20 mm proximal to the tibia plafond/joint surface. Following, all specimens were: (1) biomechanically tested over 5000 cycles under combined 1400 N axial and ±15° torsional loading; (2) rescanned. Clear space (diastasis), anterior tibiofibular distance, talar dome angle and fibular shortening were measured radiologically from CT scans. Anteroposterior, axial, mediolateral and torsional movements at the distal tibiofibular joint level were evaluated biomechanically via motion tracking.

Results

In each group clear space increased significantly after injury ($p \leq 0.004$) and became significantly smaller in reconstructed compared with both pre-injured and injured states ($p \leq 0.041$). In addition, after reconstruction it was significantly smaller in Group 1 compared to Group 2 ($p < 0.001$). Anteroposterior (AP) and axial movements were significantly smaller in Group 1 compared with Group 2 ($p < 0.001$, Figure). No further significant differences were identified/detected between the groups ($p \geq 0.113$).



Conclusions

Although both implant systems demonstrate ability for stabilization of unstable syndesmotic injuries, the screw-suture reconstruction provides better anteroposterior translation and axial stability of the tibiofibular joint and maintains it over time under dynamic loading. Therefore, it could be considered as a valid option for treatment of syndesmotic disruptions.

Funding Sources

AO Foundation – Technical Commission

Keywords

Syndesmosis, syndesmotic injury, syndesmotic stability